Natural Repellents

In contrast to synthetic repellents, there are natural repellents that are generally considered much safer. Most of these repellents are derived from the oils in plants. Most notably are essential oils—plant oils that are obtained by distillation and have the characteristic fragrance of the plant from with they are extracted. These oils produce strong odors that are offensive to mosquitoes and other insects and prevent them from landing and biting. Some oils are very effective insect repellents while others are not so good.

Some oils reported to possess insect repellent properties include:

Lemon Eucalyptus Oil

 Cinnamon Oil

Castor Oil

Rosemary Oil

 Lemongrass Oil

Cedar Oil

Peppermint Oil

Clove Oil

Geranium Oil

Thyme Oil

Neem Oil

Clove Oil

Clove oil has a long history of use in dentistry as a topical anesthetic and antiseptic. The oil is applied directly to the gums to ease the pain caused by toothaches, reduce inflammation, and kill infection. Clove oil has very potent antibacterial, antiviral, and antifungal properties, which makes it useful as a disinfectant and antiseptic. It is also an effective insecticide and repellent.

In an attempt to discover the most potent natural insect repellents, researchers in Thailand tested 38 essential oils with reported repellent properties. The investigators tested the oils at three different concentrations under laboratory conditions using human subjects. The tested oils were applied at 10 percent, 50 percent, and 100 percent concentrations. Most of the oils could not match the long-term effectiveness of DEET. The most effective oils evaluated in the study were citronella, patchouli, clove, and a Thai herb called makaen (Zanthoxylum limonella). At a concentration of 100 percent, these four oils provided 2 hours of complete repellency. Clove oil gave the longest duration of complete protection, up to 4 hours, against the three mosquito species tested.

In a follow-up study the researchers tested the mosquito repellent properties of gel products containing either 20 percent clove oil or a mixture of 10 percent clove oil plus 10 percent makaen oil. The oil mixture showed complete protection for 4 hours and an efficiency of 95.7 percent after 5 hours. The 20 percent clove oil provided full protection for 4 hours and then 86.8 percent after 5 hours. In comparison, a DEET containing product showed similar protection up to 4 hours but dropped to 82.7 percent after 5 hours. Each of these three products all gave full protection for the first 4 hours with the two essential oil products outperforming the DEET product afterwards.

Citronella Oil

Citronella oil has been used for over 60 years as an insect repellent and fragrance. It is used in many familiar insect repellent products: candles, lotions, gels, sprays, and wipes. These products, which vary in efficacy, repel mosquitoes, biting flies, ticks, and fleas.

Its pleasant lemon-like aroma gives it a distinct advantage over other insect repelling essential oils, which often have less pleasing fragrances. The major drawback to using citronella oil is its rapid volatility, which causes it to lose potency very quickly, requiring reapplication after 30 to 60 minutes. While it is highly effective, its rapid dispersal limits it use. Commercial repellents often use microencapsulated citronella oil in order to retard evaporation and prolong effectiveness.

Citronella oil has been used since 1948 without any reported adverse effects and based on animal studies has shown to have little or no toxicity when used as a topical insect repellent. The US Environmental Protection Agency (EPA) states that when used according to the label, citronella products are not expected to cause harm to humans, pets, or the environment. In Europe, however, citronella oil was banned in 2006 as an active ingredient in insect repellents. Ironically, it can still be sold as a fragrance in perfume and soap, but must not be sold for use as an insect repellent. This law is based more on politics than on any concern about health.

Lemon Eucalyptus Oil

Lemon eucalyptus is a close relative of the eucalyptus tree. Its oil is used for preventing mosquito and deer tick bites and for treating muscle spasms, toenail fungus, and osteoarthritis and other joint pain. It is also an ingredient in chest rubs used to relieve congestion.

A test of various insect repellents by an independent consumer organization found that repellents containing DEET or picaridin are more effective than repellents with natural ingredients. All of the synthetic products gave almost 100 percent repellency for the first 2 hours, where the natural repellents were most effective for the first 30 to 60 minutes and required reapplication to be effective over several hours.4 The short duration of the effectiveness of essential oils is their biggest drawback. However, there are a few oils that do have sustained protection; one of these is lemon eucalyptus oil.

The US Centers for Disease Control and Prevention (CDC) recognizes oil of lemon eucalyptus to be more effective than most other plant-based treatments, with a similar effectiveness of DEET.5 The CDC recommends equally four active ingredients for the topical application of insect repellent: DEET, picaridin, IR3535, and oil of lemon eucalyptus.

Neem Oil

One of the most promising natural insect repellents comes from the fruit and seed of the neem tree—an evergreen that is native to India. Technically, neem oil is not an essential oil because it is not produced by distillation but pressed from the seeds of the neem tree—similar to the extraction of olive or coconut oils. It has a strong odor, which no doubt contributes to its insect repelling properties. It is not known to be harmful to mammals or birds. Humans have been using it safely both topically and internally for generations.

Neem oil is not used for cooking or as a food. It is used in soaps, hair products, creams, and medicines. Folk remedies use it to treat a wide variety of health conditions such as eczema, acne, fever, leprosy, malaria, and tuberculosis. Currently researchers are investigating its use as a treatment to fight cancer, speed the healing of wounds, prevent oral plaque and bacterial infections, and kill or repel parasites and blood sucking insects.

It is an effective insecticide and is used in organic farming to repel mites, gnats, beetles, month larvae, aphids, caterpillars, locust, and other pests. It is also an effective fungicide and is used to control black spot, powdery mildew, and other fungi. It is used as a household bug repellent for ants, bedbugs, cockroaches, houseflies, sand flies, and mosquitoes.

Neem oil has been a popular insect repellent for generations. Because neem oil is far cheaper to produce than most essential oils and less harmful than chemical repellents, researchers have investigated its effectiveness as an economical bug repellent.

The traditional way to make insect repellent in the southern coastal areas of India is to mix a small amount of neem oil into coconut oil. In one study, concentrations of 1-4 percent neem oil combined with coconut oil was tested on the exposed body parts of human volunteers. The mixture was effective for up to 12 hours providing protection of 81 to 91 percent against mosquito bites. This is at least as good as a high concentration of DEET.

Some species of mosquito are more tolerant to repellents than others. So effectiveness can vary from species to species. Neem oil at 2 percent concentration in coconut oil has proven to be effective against a variety of mosquito species including those that carry malaria and yellow fever. Sand flies, another noxious biting insect, is similarly repelled by a combination of neem and coconut oils. A concentration of 2 percent neem oil and 98 percent coconut oil was tested under laboratory and field conditions against sand flies. In the laboratory, the mixture provided 100 percent protection for 7 hours. In the field, under natural conditions, the mixture provided 100 percent protection throughout the night. The results were better than DEET, which in general, is less effective against flies than it is mosquitoes. The bite from a sand fly is more irritating and lasts longer than a mosquito bite and, like a mosquito bite, can spread disease. Having an effective means of protection can be a lifesaver.

Another study evaluated neem and chinaberry oils as repellents in laboratory and field populations of sand flies in Ethiopia. In the laboratory, concentrations of 2 percent and 5 percent neem oil mixed with coconut oil provided 96.28 percent protection up to a mean time of 7 hours and 20 minutes, and 98.26 percent protection up to 9 hours, respectively. Chinaberry oil at the same concentrations mixed in coconut oil provided about the same amount of protection. A 2 percent concentration of neem oil has proven to be highly effective as a topical insect repellent. Increasing the concentration to 5 percent extends the high degree of protection a few more hours.

Neem oil can also be projected into the air to keep insects away. Kerosene lamps containing 1 percent neem oil were burned in the living rooms of villagers living near New Delhi, India. The neem oil-kerosene mixture proved to be highly effective in keeping mosquitoes at bay.

Make Your Own Insect Repellent

There are a number of commercial products that use essential oils as their active ingredients. Since some oils work better against certain types of insects, combining two or more oils provides a broader range of protection. Mixing oils also appears to have a synergistic effect, making them more potent overall.

I don’t trust the safety of repellents containing DEET and other man-made chemicals. Commercial repellents using essential oil and other natural ingredients are a better option, however, they often have ingredients I don’t like putting on my skin, such as soybean oil. Soybean and other polyunsaturated vegetable oils are commonly used as the base in which essential oils are added, but these oils create an oily film and prematurely age the skin.

You can make your own natural insect repellent that can be just as effective as those containing DEET. Clove, citronella, lemon eucalyptus, and neem oils are among the most effective. Choose one of these as your primary active ingredient. Adding another oil from this group or one from the list at the beginning of this article will enhance the effectiveness of the repellent.

Essential oils can burn or irritate if applied directly to the skin, so they must be diluted with another, skin-safe oil. Coconut oil makes a perfect carrier oil. Coconut oil works better than other oils for this purpose, because of its soothing and healing nature it calms the irritating effects of the essential oils. This allows you the option to use a larger percentage of essential oil in the formula and thus make a stronger and longer lasting repellent.

A teaspoon contains 120 drops or 5 ml. You can make a 4 percent solution by combining 5 drops of essential oil with 1 teaspoon of coconut oil. For example, 3 drops lemon eucalyptus oil and 2 drops neem oil mixed in 1 teaspoon of coconut oil would make a repellent with more potency than those used in most the above studies. Below are some measurements for making your own insect repellent.

At 4 percent concentration:

5 drops essential oil + 1 teaspoon (5 ml) coconut oil

15 drops essential oil + 1 tablespoon (15 ml) coconut oil

60 drops (or 1⁄2 tsp) essential oil + 1⁄4 cup (60 ml) coconut oil

At 5 percent concentration:

6 drops essential oil + 1 teaspoon (5 ml) coconut oil

18 drops essential oil + 1 tablespoon (15 ml) coconut oil

72 drops essential oil + 1⁄4 cup (60 ml) coconut oil

At 10 percent concentration:

12 drops essential oil + 1 teaspoon (5 ml) coconut oil

36 drops essential oil + 1 tablespoon (15 ml) coconut oil

144 drops essential oil + 1⁄4 cup (60 ml) coconut oil

Rub the insect repellent onto exposed skin using care to avoid sensitive eye areas. You will need to reapply the product after swimming, heavy exercise, or if you sweat substantially as it will wash off the repellent. Unused repellent can be stored in a dark bottle away from heat or sunlight.

When only a few mosquitoes are out, the low concentration mixture should be adequate protection. However, when mosquitoes are out in full force the higher concentration will provide more complete protection.

Essential oils as well as neem and coconut oils are available at most health food stores. They are also available online.

If you are bitten, avoid scratching as this irritates the skin and increases the itchiness and can possibly create an opening that will allow bacteria to enter and cause an infection. Apply pure coconut oil (not the repellent) to the bite several times a day. The coconut oil will help nullify the toxic effects of the insect saliva, soothe the itch, and speed healing.

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